charted the hour of commencement was found to be very distinctly later as one proceeded from west to east, and, although the figures were often contradictory, it was possible to draw lines that represent what may be called the prevailing hour of commencement. These lines are drawn in a somewhat generalized form, and it is possible that there should be more anomalous hours of commencement than those which are shown in the two small areas, one in Monmouthshire, the other west of Cambridge; but these were the only places where the weight of evidence seemed to us to demand exceptional treatment. (See fig. 2.)

Speaking generally, the isochronic lines ran from north to south, with a slight tendency to diverge southward; but it may be that they would be better viewed as concentric curves, perhaps portions of circles, the common center of which lay somewhere near the northwest of Ireland. The facts, as shown by the isochronic map, are that the snowstorm began in the north of Ireland shortly before noon of Christmas Day, or about six hours before the center of the depression arrived there, and that the storm began later and later toward the east and south, until it was after 2 a. m. on the 26th before it commenced at the mouth of the Thames, i. e., six hours before the center of the depression arrived there.

It thus appears probable that snow began in the front of the approaching cyclone about six hours in advance of the passing of the trough, and it appears likely that the snowfall lasted until immediately after the trough passed; but the hours given for the cessation of the snow are less precise than those for its commencement. At Camden Square the barograph showed that the trough passed about 6 a. m., after which the barometer began to rise, and the snow ceased about the same time.

The map shows that at noon on Christmas Day snow was beginning on the northeast of Ireland; at 2 p. m. it was snowing along a line from Islay and Kintyre to Larne; at 4 p. m. the snow reached Mull, Galloway, and almost the Isle of Man; at 6 p. m. it almost reached Skye, Glasgow, Dumfries and the coast of Lancashire; at 8 p. m. it was snowing from Skye to Manchester and thence to Cardiff and Bridgwater; at 10 p. m. the line of the commencing storm ran from the Tyne through Leeds, Sheffield, Derby and Birmingham, to near Bournemouth; by midnight it stretched from Goole to Brighton, and, sweeping over London, by 2 a. m. on the 26th, it ran from Hull through Lincoln and Cambridge to Dover. An hour later the storm had passed out into the North Sea, and the whole country was painted white from the Isle of Skye to the Isle of Thanet.

The rate of advance of the front of the storm measured by the commencement of precipitation was least rapid in the north, where it was 12½ miles an hour, and most rapid in the south, where it was about 19 miles an hour, but the rate varied a little from point to point. The interesting fact is, however, that a motor car could have kept out of the storm by traveling, without exceeding the legal speed limit, in the direction of its progress. At 8 o'clock on Christmas night snow was beginning to fall simultaneously along a line of 500 miles, this being the longest snow-yielding portion of the storm front at any time.

WELL-MARKED FOEHN EFFECTS WITH GREAT DIURNAL RANGES OF TEMPERATURE IN SOUTHERN CALIFORNIA.

By Prof. A. G. McADIE. Dated San Francisco, Cal., December 2, 1907.

Some unusual ranges of temperature were recorded in California at the close of November, 1907. A well-marked foehn effect was noticeable in southern California November 29 and 30, and December 1. Maximum temperatures of 86° occurred at Los Angeles and at San Diego on the afternoon of November 29. On the 30th, maximum temperatures of 84° occurred at Los Angeles and at San Luis Obispo, and 80° at San Diego. On December 1 maximum temperatures ranged from 80° to 85° thruout most of California.

The morning temperatures thruout this section were generally low, and at many places frost was reported in the morning. For example, at San Luis Obispo frost occurred on the morning of December 1, with a minimum temperature of 38°, which was also the temperature at the time of the observation—4:45 a. m. The temperature at the time of the regular observation preceding the frost was as high as 86°, and on the afternoon following as high as 84°. We therefore have a range of about 50°; or, allowing 32° for the frost temperature, a cooling of 54° between 3 p. m. and 5 a. m., or about 14 hours. In my experience as forecaster on this coast I do not recall such a temperature amplitude. The frost deposit was probably not heavy; but we must assume that the temperature would have been still lower but for the latent heat of condensation of vapor to water and water to ice.

The illustration is valuable, we think, in connection with the theory of the nocturnal cooling of the ground and atmosphere.[1] The observation may be of value in connection with the determination of the coefficient of radiation of air. It may be assumed that the air was clean, free from dust and water vapor; altho a puzzling condition is that San Luis Obispo is only about 10 miles from the coast. The elevation of the thermometer is about 47 feet above the ground, and the elevation above sea level is about 200 feet. It would seem that under the conditions given, the heat waves—long wave lengths—past thru the air within 40 feet of the ground, with comparatively little absorption. The fall in temperature would seem to be a pure radiation effect and the illustration shows how very important radiation is in frost formation.

THE CENTRAL PENNSYLVANIA METEOR OF OCTOBER 1, 1907.

By Prof. HENRY A. PECK. Dated Syracuse University, Syracuse, N. Y., December 13, 1907.

The evening of October 1, 1907, Mr. Clayton B. Chappell and Mr. T. H. Parkhurst, seniors in the Syracuse University, reported that they had seen a remarkable meteor about 6:30 p. m. A few days afterwards some newspaper clippings arrived, showing that it had been observed over a range of territory that extended from Toronto to New York City. Meanwhile there had appeared in New Jersey and Pennsylvania another meteor of the largest size, which had attracted universal attention over a wide area. The Central Office of the Weather Bureau made a very thoro postal-card canvass of this region, the report of which will appear in a later number of the MONTHLY WEATHER REVIEW. Among the answers were many that evidently referred to the earlier meteor, and it is largely with these as a basis that the following has been written.

Aside from the regular staff of observers of the Weather Bureau, the following have kindly furnished information:

New York.

Charles P. Arnold, Angelica.	O. H. Hauber, Ithaca.
P. J. Flanagan, Brooklyn.	Kenneth Baker, Jamestown.
Felix C. Moore, Buffalo.	W. H. Knapp, Jamestown.
Mrs. Wallace W. Jacques, Chazy.	Charles A. Hoag, Lockport.
C. E. Robinson, Clay.	Mrs. Eugene Buttrick, Lockport.
Mrs. G. O. Barnes, Cortland.	M. D. Clinton, Newark Valley.
Harold Henry, Dannemora.	William P. Ray, Olean.
F. J. Hill, Dryden.	Mrs. A. W. Ferrin, Preble.
Frank Fayent, Fort Plain.	S. C. Williams, Rochester.
Mrs. Nellie Sherman, Greenwood.	C. B. Chappell, Syracuse.
E. L. W. Smithers, Hammond.	T. H. Parkhurst, Syracuse.

New Jersey.

Samuel K. Pearson, jr., Jersey City.

[1] See S. Tetsu Tamura, Monthly Weather Review, April, 1905, vol. xxxiii, p. 138–140.

Pennsylvania.

Welcome Richmond, Dixon City.
Ignatz Gutknecht, Dixon City.
Frank T. Swartz, Dunmore.
M. L. Heisler, Harrisburg.
U. N. Steickler, Hummelstown.
Rev. J. M. Welch, Indiana.
Mrs. Malvin Edwards, Moscow.
M. E. Hathaway, Scranton.
Henry J. Hart, Scranton.
Mary Parsons, Scranton.
Howard J. Kline, Shamokin.

Virginia.

E. T. Waddill, Roxbury.

Contrary to general experience, the point of first appearance of this meteor seems to be better determined than any other point of its course. Accordingly this point was first located by the method of intersecting azimuth planes from the following observations:

Number.	Place.	Position of station. Longitude.	Position of station. Latitude.	Azimuth.
		° ′	° ′	°
1	Jersey City, N. J.	74 2	40 45	n. 65 w.
2	Orville, N. Y.	76 2	43 1	s. 30 w.
3	Dryden, N. Y.	76 18	42 29	s. 30 w.
4	Shamokin, Pa.	76 34	40 47	n.
5	Halifax, Pa.	76 54	40 26	n.
6	Lockport, N. Y.	78 40	43 11	s. 50 e.
7	Indiana, Pa.	79 10	40 40	n. 45 e.

The point whose geographical coordinates are longitude 76° 52′ west, latitude 41° 56′ north, almost exactly satisfies these azimuths, the residuals in the equations nowhere exceeding the third place of decimals. A reference to a map shows this point to be south of Elmira, N. Y., just across the State boundary line and near Dunning, Pa.

Not all the observers estimated the angular altitude above the horizon. The individual results for the elevation at which the meteor first became visible are:

Jersey City	99 miles.
Orville	71 miles.
Dryden	50 miles.
Buffalo	98 miles.
Fort Plain	91 miles.
Average	82 miles.

The Dryden estimate is so lacking in harmony with the remainder that it has been eliminated, and thruout the computation it is assumed that the meteoric mass began to glow at a distance of 90 miles above the surface.

The observations of the end point are singularly deficient in altitudes and consist almost wholly of azimuth estimates. Together with this deficiency there is also a lack of definite data upon which to found a solution by the Galle method. The method that has been followed to find the radiant point is one for which the author is responsible, and, if lacking in the quality of mathematical elegance, it is quite practical when applied to observations of this character. The various azimuths and directions in which the flight had been observed were plotted upon a map. The result showed that many of these estimates were contradictory and indicated great confusion on the part of the observers. However, there are five of the estimates that lead to a very marked intersection, and the hints received from newspaper clippings originating in the adjacent territory show that it can not be far from the true point. These observations are:

Station number.	Place.	Position of station. Longitude.	Position of station. Latitude.	Azimuth.
		° ′	° ′	°
1	Moscow, Pa.	75 33	41 17	s. 45 w.
2	Hazleton, Pa.	75 59	40 59	s. 45 w.
3	Dryden, N. Y.	76 18	42 29	s. 15 w.
4	Roxbury, Va.	77 5	37 26	n.
5	Buffalo, N. Y.	78 51	42 52	s. 23 e.

From these we deduce that the end of visibility took place in the zenith of the point whose geographical coordinates are, longitude 77° 10′ west, latitude 40° 5′ north.

Assuming the earth to be a sphere and the radius of the sphere to be the radius of curvature for the middle of the arc, the distance between the points in whose zeniths the beginning and end took place is 132 miles, and the azimuth of the point of beginning as seen from the point of ending is N. 6° 46′ E.

As stated before, the notices received are very deficient in statements of the altitude at which the meteor was last seen. This was probably due to the fact that to most of the observers it seemed to pass below the sensible horizon. A Buffalo observer thought it was extinguished at 20° altitude, but this is certainly an error. Observers at Toronto, Syracuse, and Rochester reported that it past below the sensible horizon. This would mean a probable altitude of not greater than five miles. There is another indication that it was comparatively close to the surface when extinguished. From various places in Pennsylvania near the end of the track it was reported as a detonating meteor. The great noise was heard at Halifax, Pa., about two minutes after the meteor past. This indicates a height of about 22 miles above the surface of the earth at the time of nearest approach to the observer. If the path of the meteor be drawn thru this point and the place of beginning of the flight, it will intersect the earth's surface so near the place whose latitude and longitude are given above as to be within the radius of probable error. In the remaining computations it has been assumed that the altitude at time of extinguishment was not more than five miles above the surface.

At several stations far apart the remark was made that the appearance of the meteor suggested that of an ordinary paper fire balloon. From the comparisons made with the apparent size of the moon the mass must have had a diameter of about 500 yards. When more than halfway in its course, at an altitude of not less than 30 miles, it separated into four or five bodies connected by a ribbon of light. These separate bodies continued to follow one another in the same apparent path. This would seem to show that the mass was a somewhat diffused aggregation of particles that became disintegrated, and that the particles grouped themselves according to the resistance they experienced in passing thru the atmosphere.

In order to find the elements in space it becomes necessary to find the length of the flight. Assuming that the elevation at the end of visibility was not more than 5 miles, the length of the path was 160 miles, and the altitude of the beginning as seen from the end was about 31°. Several observers give plausible estimates of the time of visible flight. These estimates average five seconds, and thus the velocity thru the atmosphere was 32 miles per second. The true radiant, free from the attraction of the earth and the effect of its motion in space, is, celestial longitude 345° 32′, celestial latitude 80° 8′.

The meteor was traveling in a path that was almost perpendicular to that of the earth, the angle between the two directions being 94°. The velocity in space before it began to feel the attraction of the earth was 27 miles per second. This is so near the parabolic limit that I have contented myself with finding a parabola that satisfies the observed direction and velocity, with the following result:

Longitude of ascending node	= 187.6°
Inclination of plane of orbit	= 86.3°
Longitude of perihelion	= 25.9°
Logarithm of perihelion distance	= 9.989

ADDENDUM.

Since the above computation was finished I have received a report of observations from Mrs. Levi Mullian, of Hartstown, in extreme western Pennsylvania, which confirms the position of the end point as above deduced, both in azimuth and alti-

tude, and which, therefore, if it had been used in the computation would not have altered the result.

I have also received a report of observations made by Mr. George F. von Ostermann and Mr. H. G. McKim, at Spalding, Prince George County, Md., which harmonizes with the orbit as given above.

THE RELATION OF THE MOVEMENTS OF THE HIGH CLOUDS TO CYCLONES IN THE WEST INDIES.

By JOHN T. QUIN. Dated St. Croix, Danish West Indies, October 30, 1907.

The following is offered in continuation of the article by the present writer, which was published under the above title in the MONTHLY WEATHER REVIEW for May, 1907.[1]

In that article it was shown that Father Viñes's theory, that, at the cirrus cloud level, the current from the vortex of a cyclone spreads out in "a completely divergent radial direction", holds good only at comparatively short distances (say between 100 and 200 miles); but that when the distance is greater the outflowing current, as shown by cirrus clouds, appears to come toward the observer from a point more and more removed to the right as the distance increases. In other words, the vortex, when at a great distance, is situated not in the direction of the radiating point of the high clouds, but in a direction to the left of that point, the amount of the divergence depending on the distance of the vortex from the observer.

It seems advisable to make a few remarks as a sort of supplement to the above-mentioned article, by way of clearing up some points that were then left in a somewhat uncertain position.

(1) In the description of the movements of the high clouds over St. Croix during the passage of the Cuban cyclone of October 17, 1906 (page 218), it is stated that, "On the 19th they were moving from the north; on the 20th at 7 a. m. from north-northeast; *on the same day at 5 p. m. again from north;* and on the 21st from east-northeast".

The part of the above statement which is now put in italics is so put to call attention to the remarkable fact that the radiating point of the high clouds, after having continued its forward movement from north as far round as north-northeast, then fell back again to north. This was left without comment in the article, but was regarded by the writer as a very weak point in the evidence, since it seemed from this irregular motion that these high clouds were not under a fixt law, but were governed by a kind of waywardness in their movements. So far, however, from being a weak point, it turned out, as will presently appear, to be one of the strongest that could possibly present itself. This was discovered when the writer, desiring to find out whether this hurricane, on leaving Florida, went forward over the Atlantic, as the movements of the high clouds here seemed to indicate, or whether it went off to the northwest, as stated in a telegram received here, lookt up the MONTHLY WEATHER REVIEW for October, 1906, and found there (page 479), in regard to this great storm, the following:

> On the morning of the 17th, reports indicated the presence south of western Cuba of a well-defined cyclonic disturbance, and at 11 a. m. of that date storm warnings were ordered on the east Gulf, Florida, and south Atlantic coasts, and the following was telegraphed to Atlantic and Gulf ports, and to Havana, Cuba: "* * * Disturbance apparently approaching western Cuba from the Caribbean Sea. Unsafe for vessels next few days off western Cuba, Florida, and south Atlantic coasts."
>
> The center of the storm past near and east of Havana at 11:30 p. m. of the 17th, with minimum barometer at Havana, 28.86 inches, and by the morning of the 18th had reached a position near and to the eastward of Key West, where at 3 a. m. a minimum barometric reading of 29.30 inches was registered. Moving thence northeastward to a point about opposite the South Carolina coast, the center recurved to the westward, *and was then forced southward over the Florida Peninsula* by an area of high barometer that covered the north Atlantic coast districts.

[1] Vol. XXXV, p. 215–218.

The italics are the present writer's and are used to call attention to the striking fact that the cyclone center, after proceeding toward the northeast, paused and *went back to Florida.* This is just what the high clouds said it did. Precisely at the time that their action lookt capricious they were closely following the law that appears to govern their movements. The cyclone advanced from Florida northeastward out into the Atlantic, and the radiating point of the high clouds at St. Croix answered by an advance from north to north-northeast; but now the cyclone, checked in its course, returns to Florida, and the radiating point of the high clouds at St. Croix thereupon falls back to the north. If we could fix the exact hours when the changes took place, both for the cyclone center and for the clouds, we should be able to tell just how long it took for the high currents to reach St. Croix from the vortex of the storm.

The notice of the storm from which the quotation is taken does not say what became of the cyclone after its return to Florida. According to the story of the high clouds, as told at St. Croix, it started once more on its movement over the Atlantic, and on this second occasion continued on its course for several days. If the high clouds were not on their trial, we might, after their accurate report about the recessional movement, take their word for the rest of the story; but as they are on their trial, all points must be supported by independent evidence. And as there is no evidence accessible, the latter part of the story must still remain unconfirmed.

(2) In the article in the May number it was remarked in connection with the above storm—

> If it proves to be likely that there was a connection between the cirrus clouds and the cyclone in the above last-named case, then this connection existed at a distance of about 1,200 miles, the distance between St. Croix and Havana. That would be a very striking fact, if we could establish it.

Now it will perhaps be admitted that the remarkable agreement between the unusual movements of the cyclone center and the unusual movements of the high clouds, as above pointed out, amounts, when taken with the other facts, almost to a proof that the connection in question did exist when the cyclone left Florida and returned thereto. But the distance of the vortex from St. Croix must then have been about 1,100 miles, or nearly as great as the distance to Havana. Hence there seems to be strong ground for believing that the influence on the upper air of the movements taking place in the vortex of a cyclone extends even to such a great distance as 1,200 miles.

(3) In the same article, reference was made to some figures given by Mr. Page, in an earlier number of the MONTHLY WEATHER REVIEW, concerning the direction of cirrus cloud movements at Havana, but as the said earlier number was not then at hand the figures could not be quoted. They have since been found in the MONTHLY WEATHER REVIEW for July, 1904 (page 311). They represent Mr. Page's analysis of the frequency of upper cloud motions during hurricane months, as observed at Belen College, Havana, and are as follows:

Clouds.	Number of observations.	Percentage of frequency of movement from—			
		NE.	SE.	SW.	NW.
Upper	645	23	8	39	30

From this it will be seen that 69 per cent of the movements noted were from westerly points, while only 31 per cent, not quite one-third of the whole, were from easterly points, so that it is hard to see how Father Viñes could have arrived at the conclusion that there is a "superior general current which at that time of the year (the hurricane season) comes from the eastern quarter".